Using multi-temporal LiDAR to assess fire impacts on tree growth

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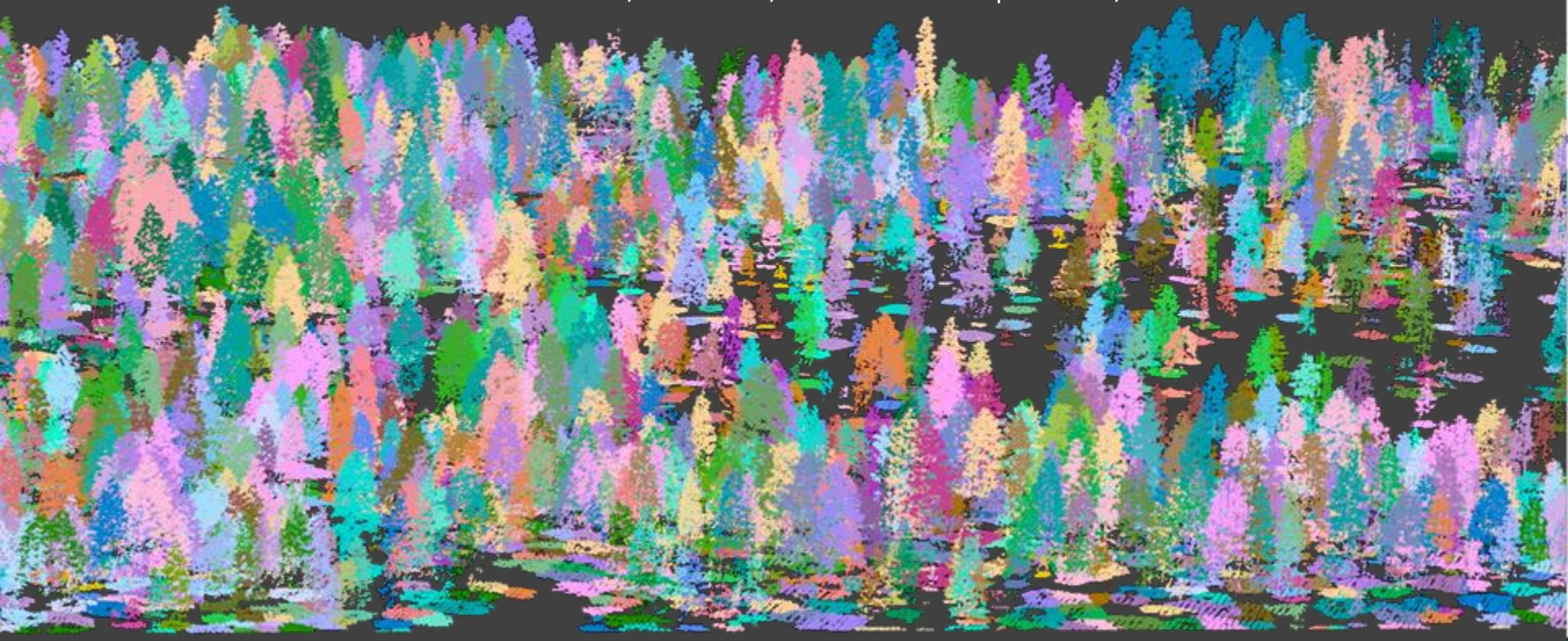


Research Motivation

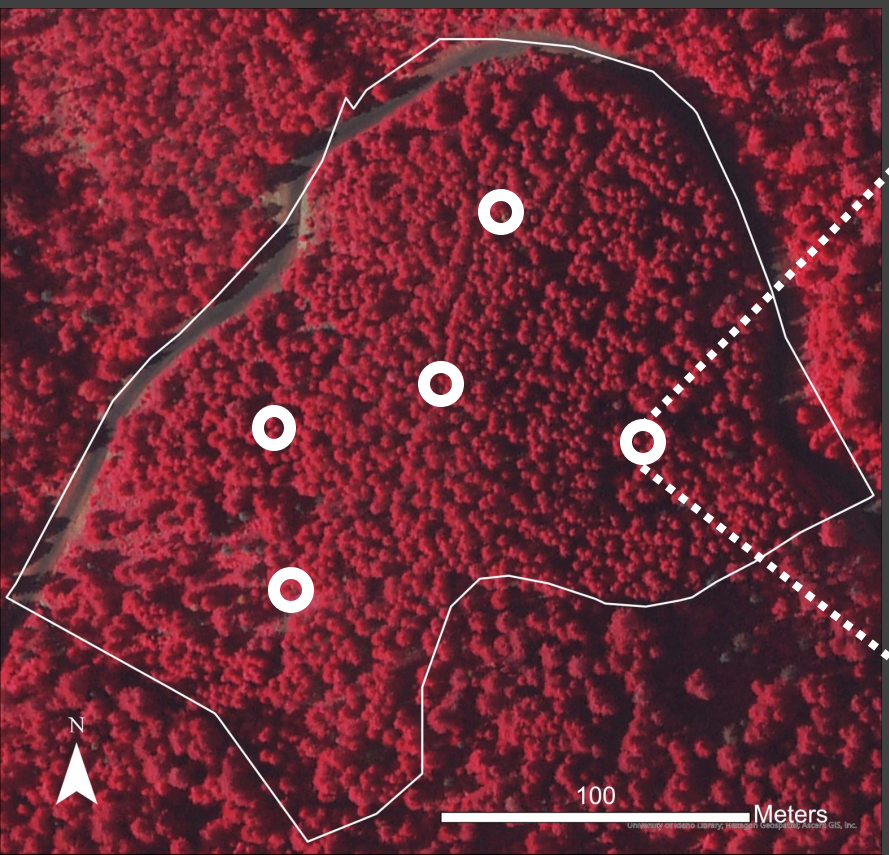
Why is monitoring forest growth important?

- Forest monitoring essential for management planning
- Timber activities vital part of Idaho/PNW economy (jobs, revenue)
- We rely on numerous wood products *every single day*

A little history…

Forest inventory: what – and how much – is out there?

- Sub-sampling of forest conditions using field plots
- Re-measured over time to capture growth/change



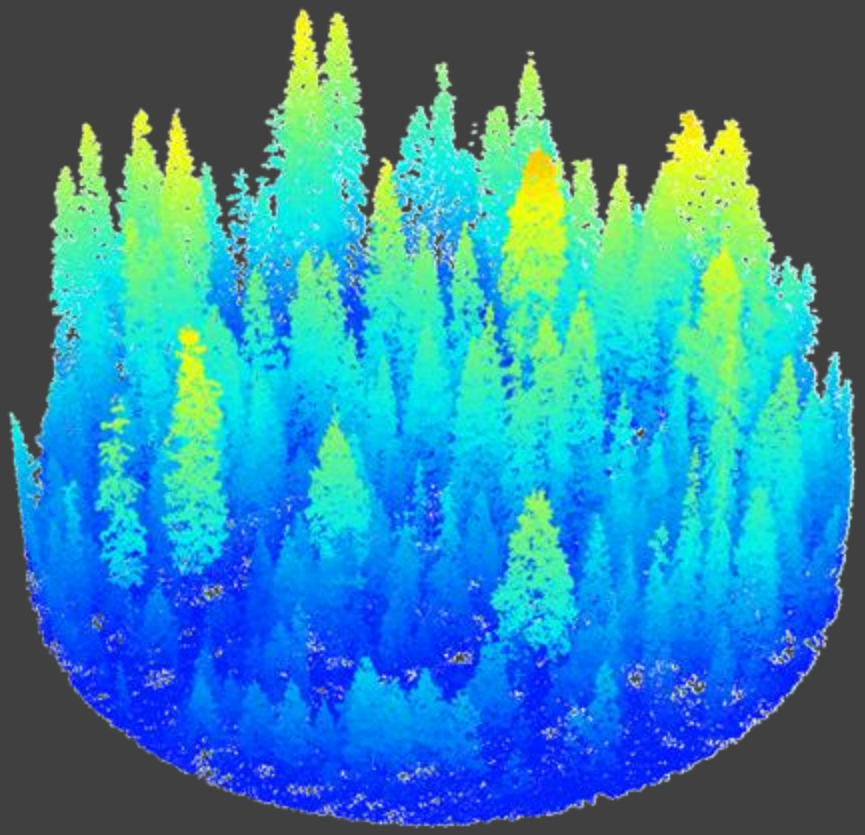
Moving from spatially incomplete inventory to spatially complete inventory

- Airborne LiDAR (aka airborne laser scanning - ALS)

Source: Eagle Mapping

LiDAR (Light Detection And Ranging)

- Produces 3D ‘point clouds’ of target landscapes
  - ‘Digital Forests’



LiDAR – Going Beyond 2D characterization

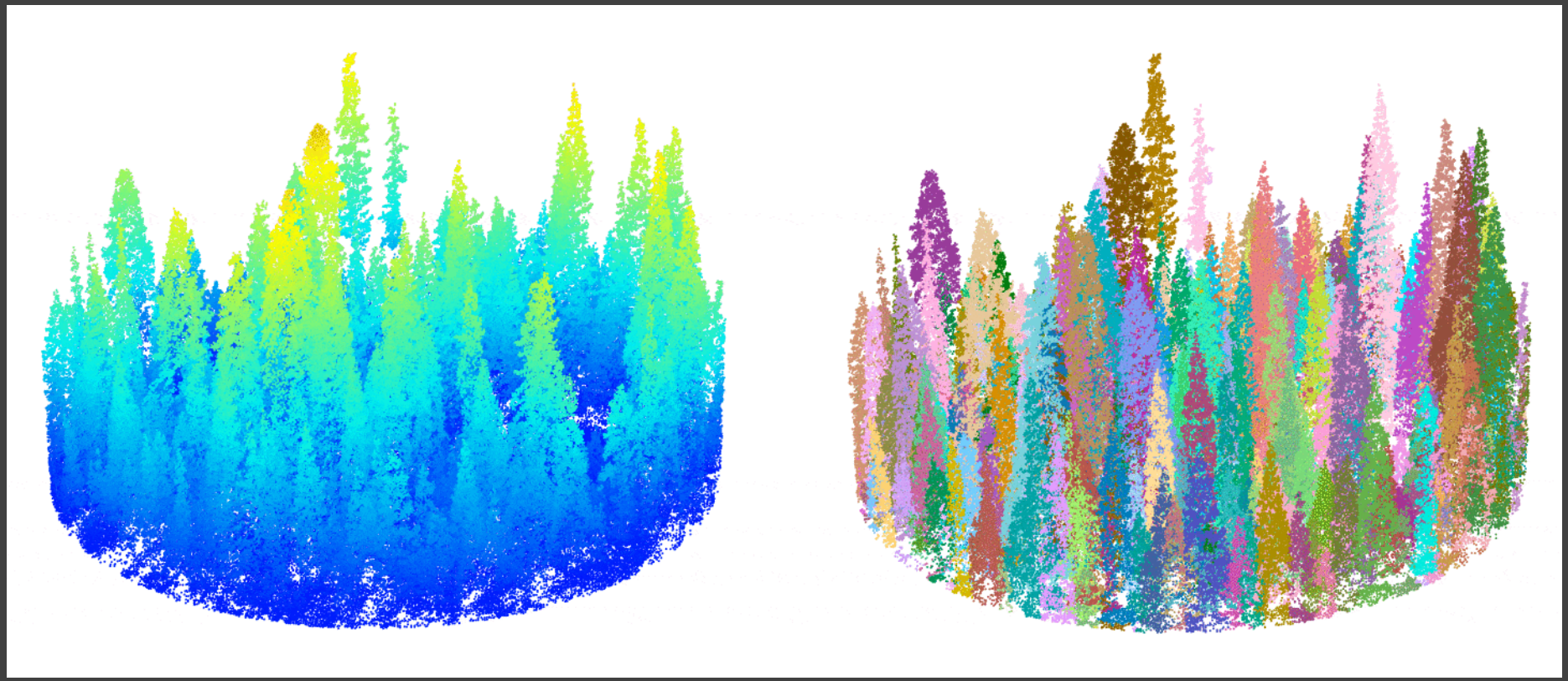
- Each point within point cloud has x and y location and z height + other information

- Stored in '.las' file format:

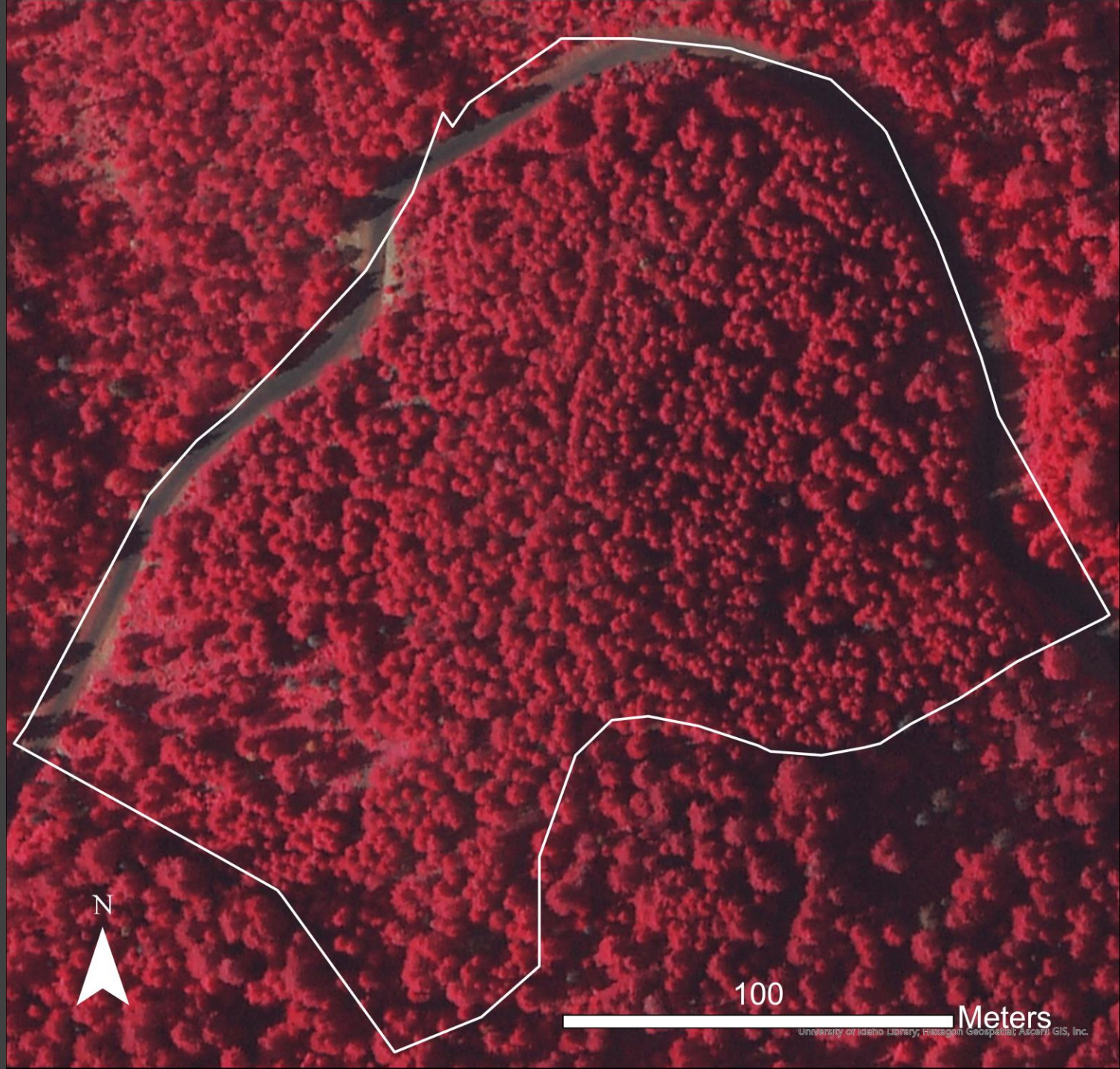
x	y	z	Gps time	Intensity	Return #	# of Returns	Class
604906.9	4893536	10	346674	109	1	1	2
604906.6	4893536	10.1	346674	77	1	1	2
…	…	…	…	…	…	…	…

Individual tree detection

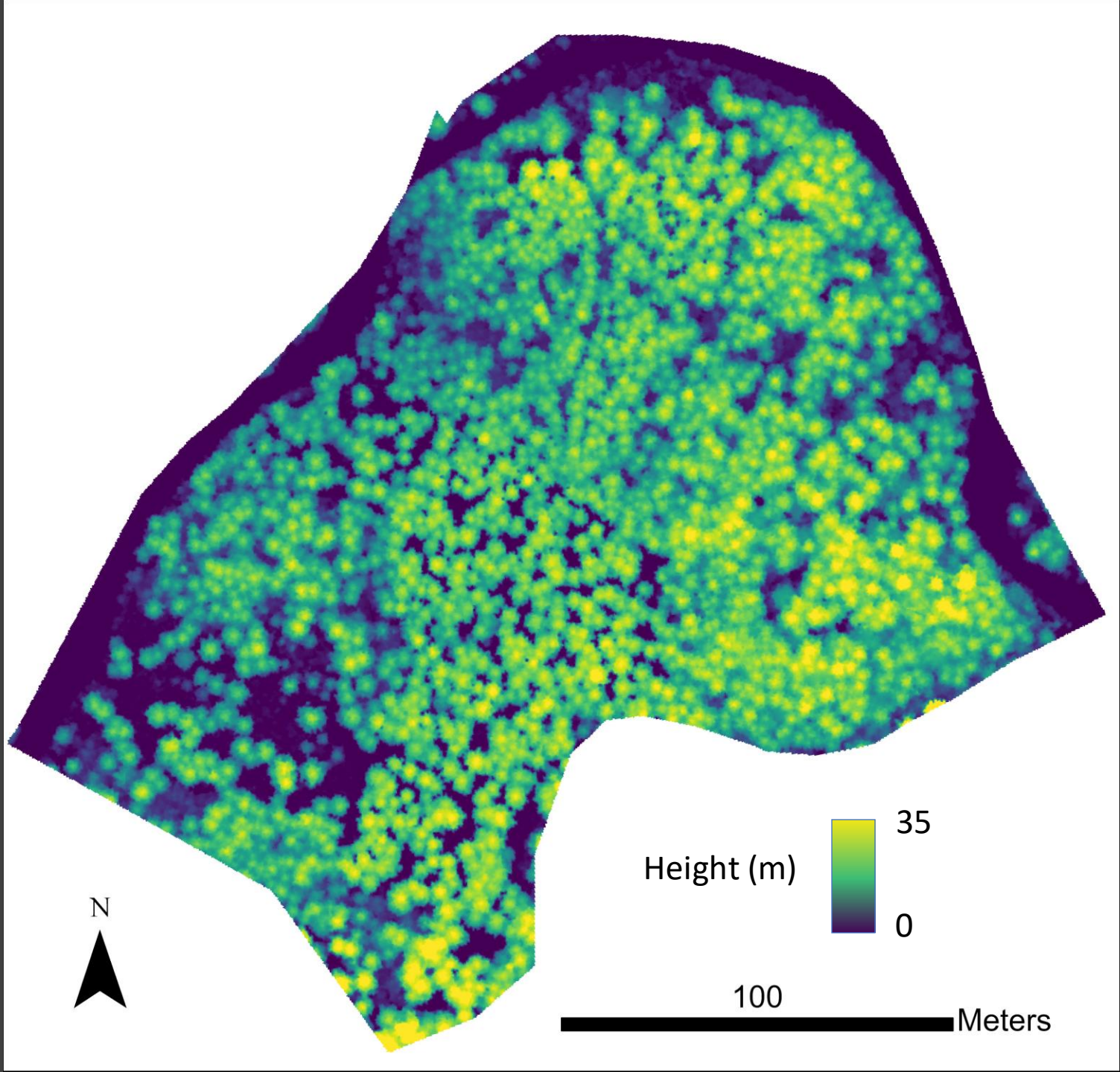
Moving from samples to census:
Identification and segmentation of individual trees



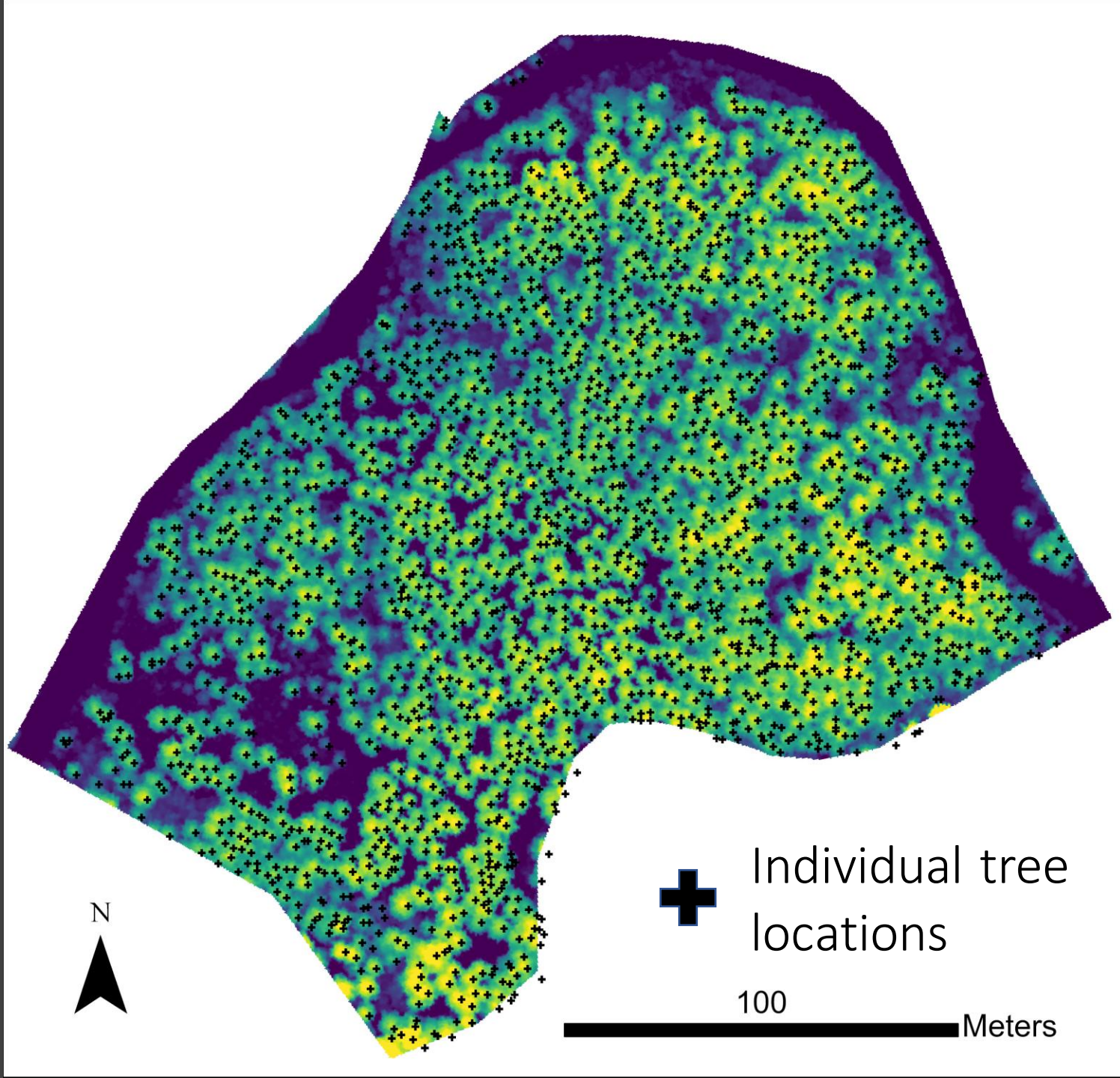
Individual Tree Detection



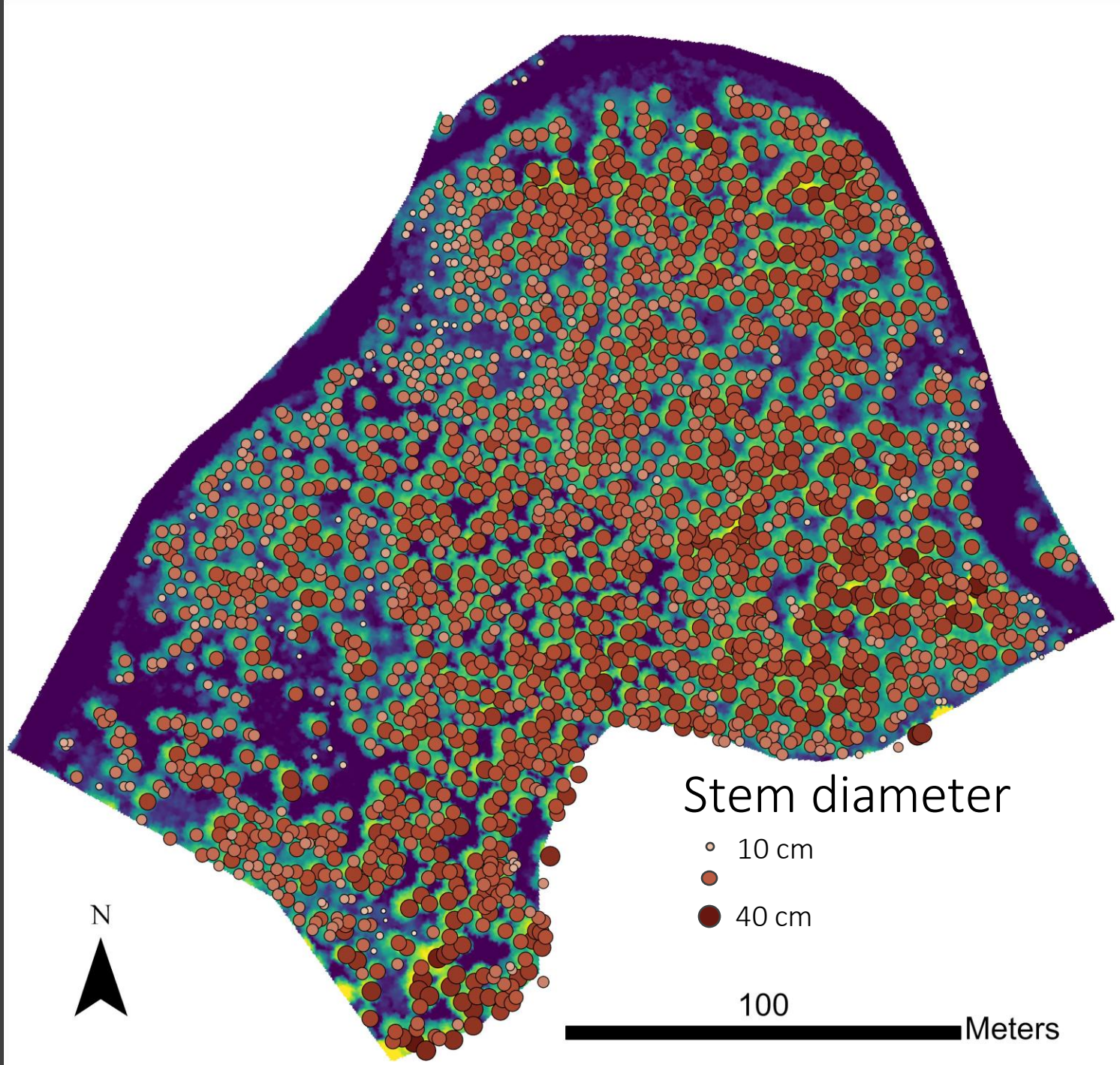
Individual Tree Detection



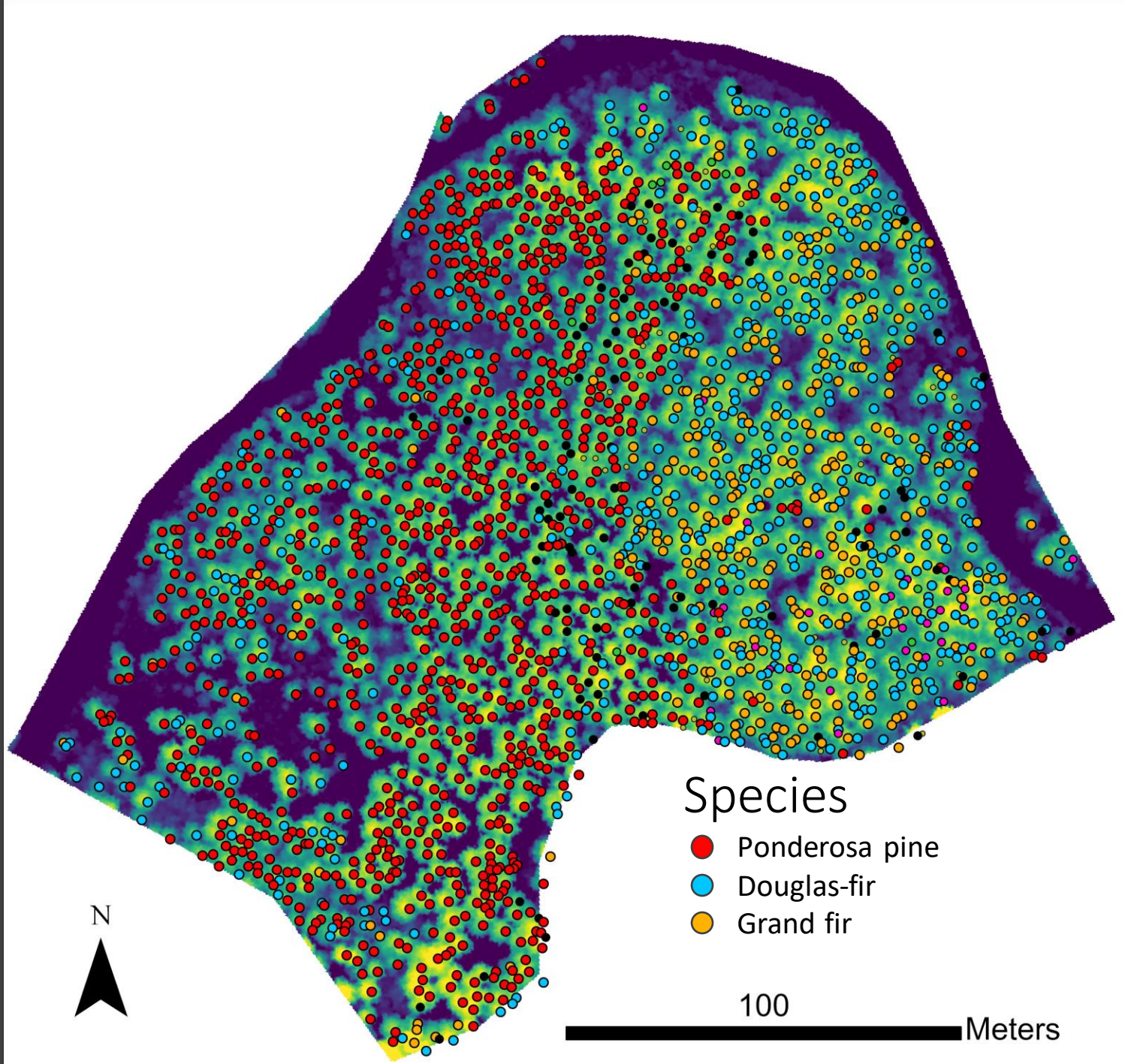
Individual Tree Detection



Individual Tree Detection

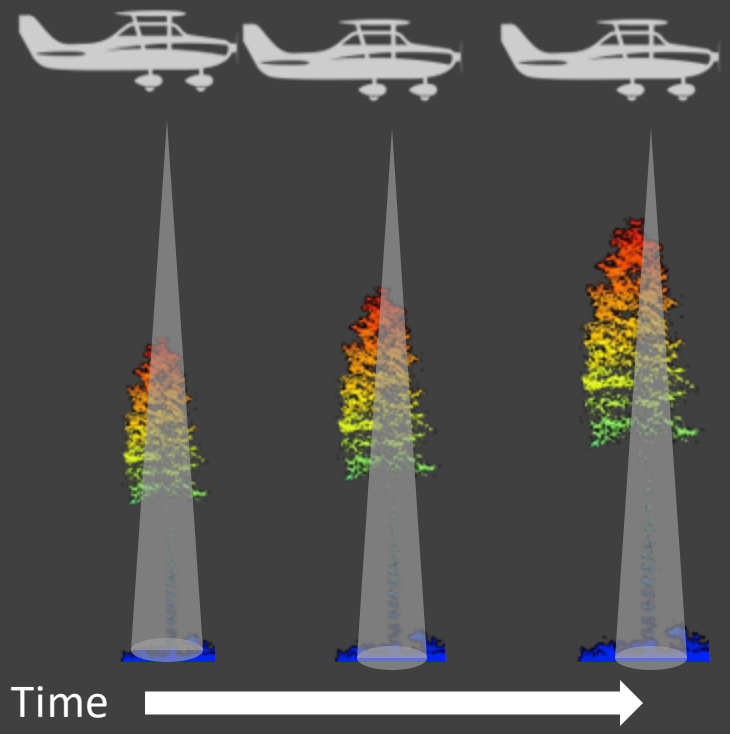


Individual Tree Detection



Individual tree growth

Multi-temporal LiDAR
+ individual tree identification
= individual tree growth



Fire impacts on growth

Study design

- 3 forest stands, half of each burned in 2014
- Fire intensity measured via *in situ* infrared radiometers
- Increment cores collected ~2 years post-fire
- ALS data collected in 2019, 2020, 2022

Pre-fire

Rx fires

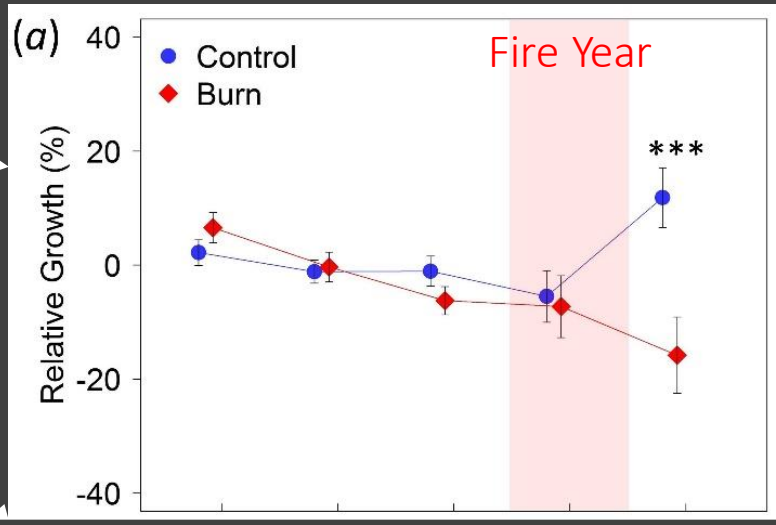
Post-fire

Fire impacts on growth

Results

- Radial growth reduction for burned vs non-burned trees

- This reduction varies with remotely sensed fire intensity!

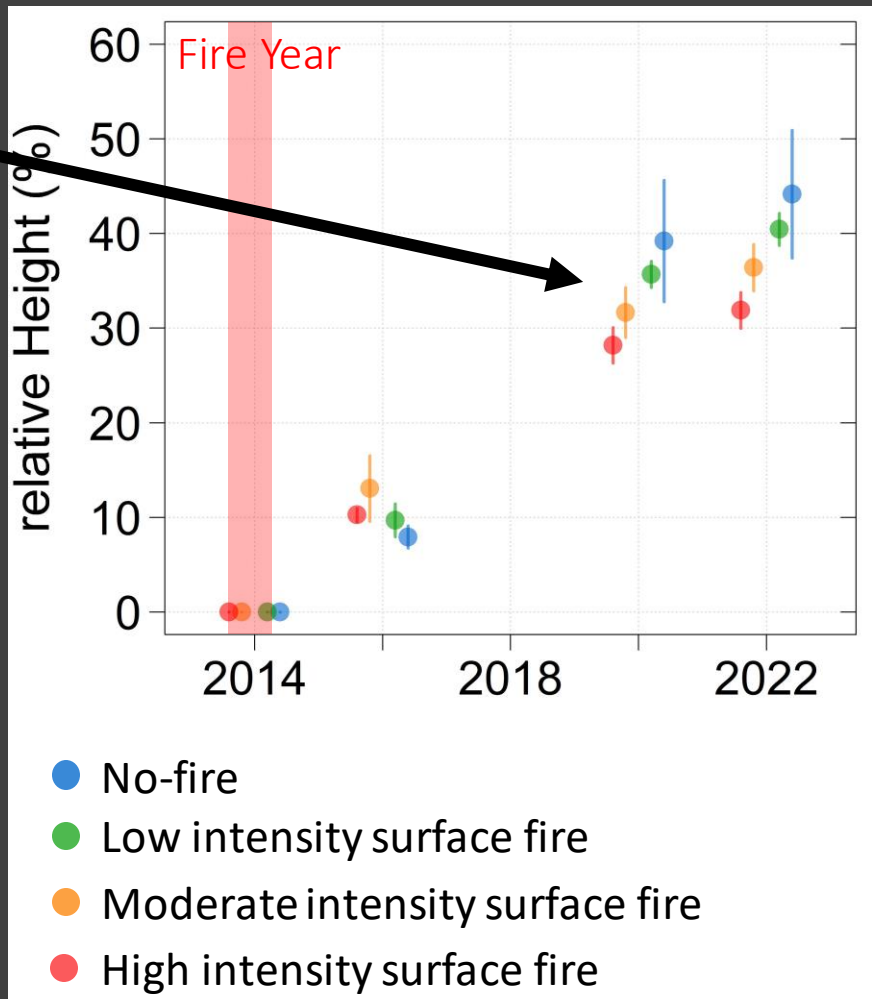


Sparks *et al.* (2017) Int. J. Wildland Fire

Fire impacts on growth

Preliminary Results

❖ Long-lasting height growth reduction with increasing fire intensity



Fire impacts on growth

Importance and application:

- Better understanding of size and species dependent fire effects
- Guide for managers on Rx burn intensity
- Fire-productivity relationships could inform forest growth and earth system models
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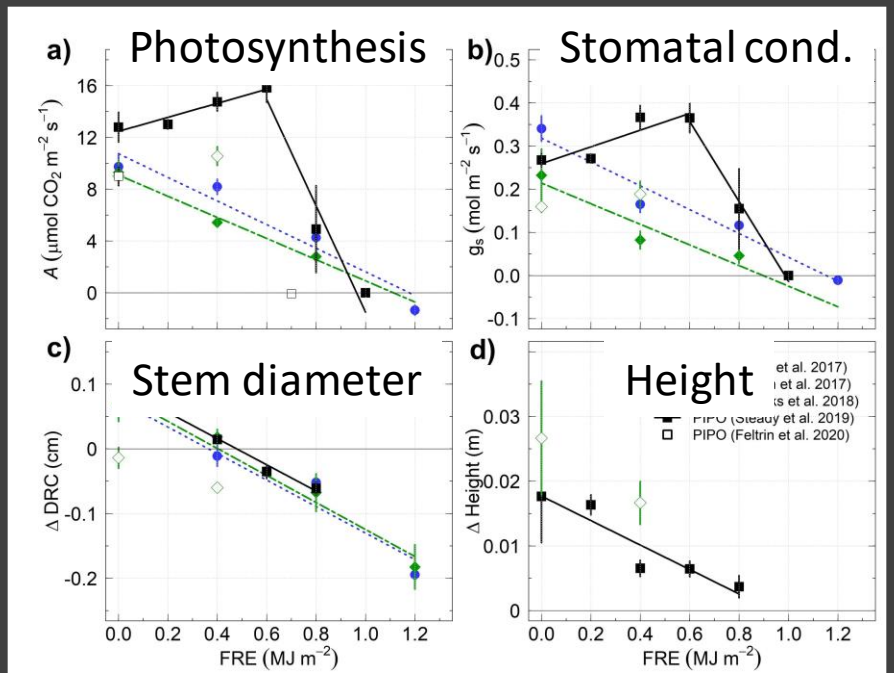

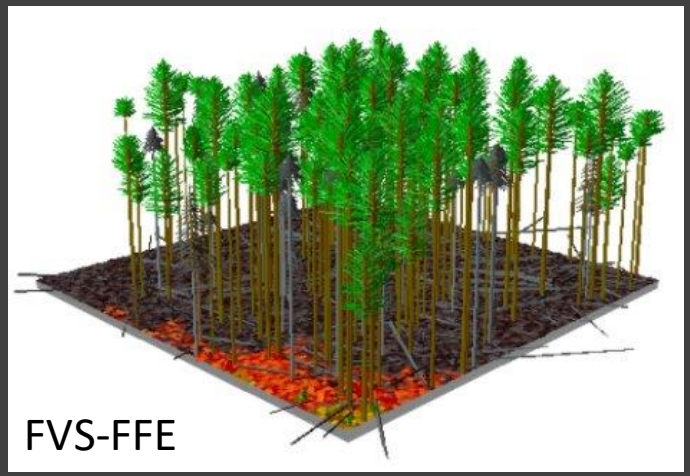

Thanks for your attention!

Where to find our latest research:

ResearchGate: researchgate.net/profile/Aaron-Sparks

Twitter: @double_A_R0N

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